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THE IMPACT OF CANADA'S CHANGING INDUSTRIAL MIX OF EMPLOYMENT ON THE OCCUPATIONAL STRUCTURE

by

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ABSTRACT

This paper reviews changes in the industrial structure of employment over the past 30 years. Using data for 41 industries, it calculates two indexes of structural change (in industrial employment) for the periods 1951-61, 1961-71, 1971-81 and 1981-84. Most importantly, it determines the influence of change in the industrial mix of employment on the occupational structure in Canada for the 1971-81 period. This is of interest because most occupational forecasting models of the "fixed coefficient" type assume that change in the occupational structure is determined largely by changes in the industrial structure of employment; that is, the occupational mix within industries is assumed to remain constant over time. This analysis contributes to the understanding of the underlying causes of change in the occupational structure of employment.

Major findings are:

(1) The pace of structural change in industrial employment was highest during the 1950s and 1960s, and slowed considerably during the 1970s and the period leading up to the 1981-82 recession. Since the recession, however, the pace of change has increased again.

(2) On average (across all occupations), from 42% to 45% of the total change in occupational shares of employment between 1971 and 1981 was attributable to changes in the industrial mix of employment (changing the industrial structure). The remainder was due primarily to changing occupational structures (i.e. distributions) within industries. But there is enormous variation by occupation, ranging from the management/administrative occupation - where the changing industrial mix of employment accounted for only 10% of the occupation change in share - to the occupation of farming, where the corresponding figure is 84%.

(3) In general, among highly qualified occupations (requiring college or university graduation) the changing industrial structure was less important in determining changes in the occupational mix than among blue collar occupations. For the former group, on average 31% of the change in occupational employment shares was due to the changing industrial structure, among the latter group, 51%.

(4) The rapid change in the industrial structure of employment since 1981 may make "fixed coefficient" approaches more useful in tracking occupational trends than was the case in the 1970s, although it is also necessary to consider the pace of change in the occupational structure within industries in the 1980s, and about this we know very little.

INTRODUCTION

The pattern of industrial activity, and hence, of employment, is always changing. New jobs in new industries are created as old jobs disappear. Recent research indicates that there are an unexpectedly large number of firms starting and failing as a result of the constant change in domestic demand, trading patterns, technology and for other reasons. This very dynamic pattern of births and deaths of firms, combined with job loss and creation in on-going firms can, in a relatively short period, lead to a change in the industrial structure of employment. Canada has already witnessed the decline in the agricultural sector and the rise in manufacturing and other goods-producing sectors, followed in more recent decades by the rise in the services sector.

This change in the industrial mix of employment results in a concurrent change in the occupational employment structure. As demand for labour rises in industrial sectors requiring more highly skilled labour and demand falls (or rises less slowly) in sectors utilizing less skilled labour, the occupational structure of the economy shifts. Thus, shifts in the industrial structure of employment lead to shifts in the occupational employment.

But the occupational distribution in the economy could change even if the industrial structure did not. The type of jobs within industries change over time. Such a change could result from the application of new technologies in the industry, a shift in the types of goods or services (commodities) produced by the industry, a change in the production processes used in the industry, and no doubt for other reasons. Each of these factors affects the type and quantity of labour required to produce the industries output, and thus affects the occupational structure within that industry. Thus, even if the industrial structure (distribution) of employment remains fixed, the occupational structure in the economy as a whole could change as a result of changes in the type and quantity of labour required within industries.

In this analysis, then, there are two major causes of change in the occupational structure of employment:

(1) changes in the mix or distribution of employment among industries, and
(2) changes in the mix or distribution of occupational employment within industries.

The emphasis in this paper is on the first factor, and on the question of the degree to which this has been the cause of the observed change in the occupational mix of employment between 1971 and 1981.

More specifically, the objectives of this report are: (i) briefly review changes in the industrial structure of employment that have occurred over the past 30 years or so, and (ii) determine the extent to which changes in the occupational structure of employment between 1971 and 1981 are attributable to changes in the employment mix by industry.

There are at least two reasons for being concerned with this topic. First, most projection models in Canada used to project manpower requirements by occupation employing "fixed-coefficient" methodologies to convert projections of manpower requirements by industry to requirements by occupation. It is assumed that the occupational distribution within industries does not change over the projection period. (That is, that factor (2) listed above does not significantly influence the occupational structure.) It is assumed that change in the occupational structure of employment is entirely due to change in the industrial structure. Assessing the degree to which this was actually true during the 1971-81 decade will help analysts to construct and use these models to better understand their strength and weaknesses, at least with regard to this part of the methodology.

Secondly, aside from the implications for manpower models, some knowledge of the underlying causes of changes in the occupational structure is of interest by itself. It is important to know if such change is caused primarily by shifts in occupational distribution within particular industries (indicating significant change in types of manpower required by the industries possibly due to technological change, changes in production processes, changes in capital/labour ratios within the industries, etc.), or if it is mostly

explained by inter-industry variations in the growth of employment.[1] Such knowledge improves our understanding of the forces which cause change in the occupational structure in Canada.

THE CHANGING INDUSTRIAL STRUCTURE OF EMPLOYMENT, 1951 TO 1984

Before assessing the importance of the two earlier mentioned factors in determining the overall occupational employment mix, a brief review of the change in the industrial structure of employment itself (factor one) is done.

To do this, census data on the experienced labour force[2] in 42 industries[3] for years 1951, 1961, 1971 and 1981 are used. (Distributions and changes in shares for these industries are given in Table 7. As well, labour force survey data on employment in the 44 industries is used for 1981 and 1984. Distribution and changes in share using these data are in Table 8.)

To help simplify the observations, industries have been aggregated to produce seven major sectors. The distributions and changes in share of their respective labour force's are in Tables 1 and 2.

Examining the change in the industrial shares at a very aggregate level yields the following observations:

1. The service sector's share of employment rose in all periods, but much faster during the 1950s (i.e., 1951-61) and 1960s than during the 1970s (their share increased 8.9, 6.2 and 4.1 percentage points during the

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1 Which is itself caused by a number of factors such as changes in domestic demand for domestically produced goods and services, changes in the demand for imports and exports, inter-industry variations in productivity. For an introductory review of this topic, see G. Picot, Canada's Industries: The Growth in Jobs over Three Decades, Statistics Canada Catalogue Number 89-507.

2 This includes all the employed, plus the unemployed who had worked during the previous 17 months.

3 These data have been compiled using the same industrial coding system (the 1970 SIC) for all years.

Table 1: Percent Distribution of the Experienced Labour Force by Major Sector, 1951 to 1984

Major Sector*	Census[1]				Labour Force Survey[2]	
	1951	1961	1971	1981	1981	1984
Agriculture	15.6	9.9	5.8	4.1	4.4	4.3
Manufacturing	24.7	22.1	21.3	19.1	19.3	17.9
Other Goods-producing	12.8	12.2	10.8	10.6	10.0	9.0
Total Goods-producing	53.1	44.2	38.0	33.8	33.7	31.2
Distributive Services	23.3	24.2	23.5	23.8	24.2	24.2
Producer (Business) Services	3.8	5.4	7.2	9.5	9.4	9.9
Consumer Services	7.3	8.6	9.2	10.8	10.9	11.6
Total Commercial Services	34.5	38.2	39.9	44.0	44.6	45.7
Non-commercial (Public) Services	12.4	17.6	22.1	22.1	21.7	23.1
Total Services	46.9	55.8	62.0	66.2	66.3	68.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

[1] Data for 1951 to 1981 are census data on the experienced labour force (employed plus the unemployed who had worked during previous 17 months).
[2] Data for 1981 and 1984 are labour force employment data.

Table 2: Change in Share of the Experienced Labour Force by Major Sector, 1951 to 1984

Major Sector*	Census			Labour Force Survey
	1951-61	1961-71	1971-81	1981-84
Agriculture	-5.7	-4.0	-1.7	-0.1
Manufacturing	-2.6	-0.8	-2.2	-1.4
Other Goods-producing	-0.6	-1.4	-0.2	-1.0
Total Goods-producing	-8.9	-6.2	-4.1	-2.5
Distributive Services	0.9	-0.7	0.3	0.0
Producer (Business) Services	1.6	1.8	2.3	0.5
Consumer Services	1.3	0.6	1.6	0.7
Total Commercial Services	3.7	1.7	4.1	1.1
Non-Commercial (Public) Services	5.2	4.5	0.0	1.4
Total Services	8.9	6.2	4.1	2.5

* Definitions of the Major Sectors are in the Appendix.

three decades). Its share then rose quite quickly (2.5 percentage points) over just three years between 1981 and 1984.

2. Non-commercial (public) services contributed most to this expansion during the 1950s and 1960s, but the commercial service sector was responsible for the entire gain of 4.1 percentage points between 1971 and 1981. Between 1981-84, both the public and commercial services sector increased their share of employment.

3. The gains over the 1981-84 period in the service sector share was quite different from the gains during the earlier decades. The shift to the service sector in the latter period was due primarily to a decline in employment in the goods-producing sector, not to a rapid increase in service sector employment, as was the case in earlier decades. Thus, the data on percentage share can be somewhat misleading.

4. Employment in the goods-producing sector was 7.4% lower in 1984 than in 1981; that in the services sector was 3.7% higher (only an annual average growth of 1.2% between 1981 and 1984). Of course, employment growth in all sectors was quite erratic during this period due to the 1981-82 recession and its aftermath.

5. The overall result is that the change in the employment distribution, at least as between the goods-producing and services sector, was slower during 1971-81 period (service sector gaining 4.1 percentage points) than during the 1950s or 1960s (the service sector gaining 8.9 and 6.2 points respectively). During the 1981-84 period, the change was again quite rapid, as the service sector gained 2.5 percentage points in only three years.

Index Values of the Degree of Change in Industrial Employment Distribution

This totally descriptive approach is not, of course, a very satisfactory way of measuring the pace at which the restructuring of employment among industries and sectors is occurring.

Two methods are used to provide index values of the amount of change in the industrial distribution. These index values are then compared for the different periods (1951-61, 1961-71, 1971-81 and 1981-84) to determine the periods during which the change was the greatest. Of course, the fact that the last period is only three years long, and the others 10 years must be considered. The two methods are as follows:

(1) Index of Dissimilarity in the Industrial Distributions

This index is often used in demography to measure the amount of change in, say, two age distributions over time. The index is simply the sum of the absolute value of the difference in the two distributions, divided by two. In this case, the comparison is between distributions of the labour force by industry as of census years.

Let I_{it} denote the proportion of labour force of year t that is in industry i, where there are n industries. The index value, $IND1_{t,t+1}$, for the period t, t+1 is then

$$IND1_{t,t+1} = \frac{1}{2} \sum_{i=1}^{n} |I_{i,t+1} - I_{i,t}|$$

The larger the index value, the more dissimilar the two distributions. In this case, the larger the index value, the greater the change in the industrial mix of employment during the period of interest. Of course,

it is necessary to have periods of equal duration before the index values are directly comparable.[4]

It should be noted that the index of dissimilarity is based primarily on changes in shares (as opposed to growth rates). Thus large industries tend to dominate the calculations. A large industry with a low growth rate (but relative large change in share) in employment may carry more weight in the index calculations than a very small industry with rapid growth (but small change in share) in employment over the period.

A second index is used which will provide equal weight to all industries in the calculation, independent of their size (i.e., their share of total employment).

(2) Standard Deviation of the Log of Changes in the Labour Force

This index is based on the growth rate in employment between the two years of interest. The natural logarithm of the growth is used because

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[4] Another consideration is the position of the business cycle when the industrial distributions are measured (i.e., census day). The concern here is with long-term change in the industrial structure, and its impact on the occupational structure. Thus, one does not want differences in the position of the business cycle to unduly influence the results. Fortunately, all census points (June) of 1951 to 1981 were roughly in the same stage of the business cycle - either well into an expansionary period or just before a decline. The points were as follows:

June '51 - end of expansionary phase, just before '51 recession
June '61 - expansionary phase, 6 months after low point of 1960 recession
June '71 - expansionary phase, 6 months after low point of 1970 slowdown
June '81 - end of expansionary phase, 1 year after low point of 1980 recession and 1 month before start of 1981-81 recession

See P. Cross, The Business Cycle in Canada, 1950-81, Current Economic Analysis, March, 1982, Statistics Canada Catalogue Number 13-004.

of some undesirable properties of percentage changes.[5]

We are concerned with the variation in the growth rate among all industries. If all industries grow at the same rate, the distribution of employment will not change. The larger the variation in the growth rate among the industries, the greater the change in the industrial distribution of employment. The standard deviation is used to measure the variation in growth, which is in turn measured by the natural logarithm of the ratio of employment in the two years.

Thus, the index becomes

$$IND2_{t,t+1} = \text{STD DEV.} \left(\ln \frac{X_{1,t+1}}{X_{1,t}} , \ln \frac{X_{2,t+1}}{X_{2,t}} , \ldots \ln \frac{X_{n,t+1}}{X_{n,t}} \right)$$

where $X_{i,t}$ denotes the employment in industry i, year t. Note that each industry contributes equal weight in this index, independent of its size.

The two indexes were computed using 42 industries in Table 7 and 44 industries in Table 8. Results are shown in Table 3 and Chart 1. They are calculated for the periods 1951-61, 1961-71, 1971-81 and 1981-84. The last period is only three years, and obviously one would not expect as much change in the industrial mix of employment over three years as over 10 years.

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[5] For example, if an industry doubles its employment, this represents a 100% growth. However, if an industry's employment is cut by a factor of 2 (i.e., is one-half its earlier value), its decline is only 50%. Percentage increases can be infinitely large, but percentage declines cannot be more than 100%. This introduces a bias in any index calculation, as industries with large percentage increases will dominate the calculation.

To overcome this, natural logarithms are used, because of the property that

$$\ln x = - \ln \frac{1}{x}$$

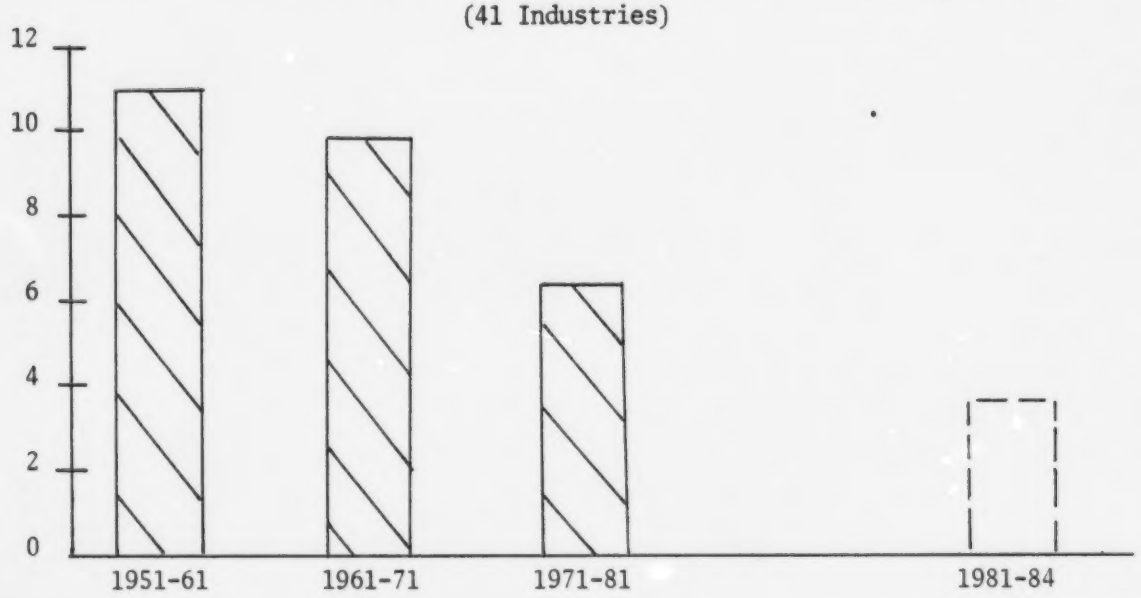
Hence, if an industry increases its employment by a factor of 2, it will have the same weight in the calculation as an industry that has decreased its employment by factor of 2 (i.e., is at $\frac{1}{2}$ of its former level).

Table 3: Indexes of Change in the Distribution of Employment by Industry

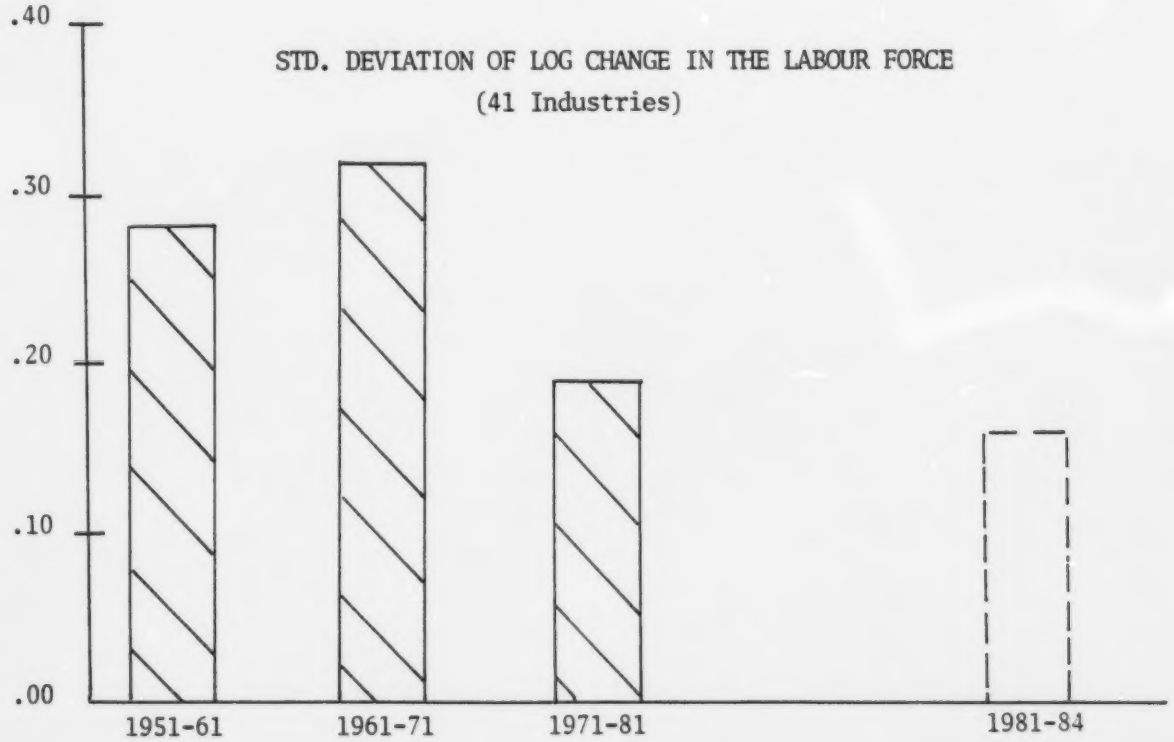
	1951-61	1961-71	1971-81	1981-84
Index of Dissimilarity (IND1)	10.8	10.0	6.8	3.6
Std. Dev. of Log Changes in Labour Force (IND2)	0.28	0.32	0.19	0.14

CHART 1

INDEX OF DISSIMILARITY IN INDUSTRIAL DISTRIBUTIONS OF THE LABOUR FORCE
(41 Industries)



STD. DEVIATION OF LOG CHANGE IN THE LABOUR FORCE
(41 Industries)



The results clearly show that:

(1) The degree of change in the industrial distribution of employment was considerably less during the 1971-81 decade than either the 1951-61 or 1961-71 decades. Leading up to the 1981 recession, the industrial restructuring of employment had been slowing.

(2) The degree of change in the industrial distribution of employment during the 1981-84 period was considerable, even though this was only a three-year period. One index indicates the change during the three years was 50% of that experienced during the 10 years between 1971 and 1981. The other index indicates the three year change was 70% of the 1971-81 value. This is due in large part to the effect of the recession on the goods-producing sector, and the fact that even by 1984 it had not recovered to the 1981 level, while service sector employment had grown.

The degree to which the changing industrial mix of employment can lead to changes in the occupational mix depends, of course, on the magnitude of the change in the industrial mix. If there is very little restructuring of industrial employment, it cannot have much effect on the occupational mix.

Industrial restructuring was relatively high during the 1950s and 1960s, and again following the 1981 recession; it was much less during the 1970s. Thus, all other things being equal, one would expect the changing industrial structure of employment to influence the occupational mix to a greater degree during the 1950s, 1960s and 1980s than during the 1970s. Of course, this is not the only factor that influences the occupational mix. There is of course some change in the mix of occupations within industries.

Assessing the Importance of Industrial Restructuring as a Determinant of Change in the Occupational Structure

As mentioned earlier, most occupational manpower requirements models assume that the occupational mix within industries does not change over time (i.e., they used "fixed coefficients" in the industry/occupation matrix). This is the same as assuming that all change in the occupational distribution of labour requirements stems from changes in the industrial mix of employment.

Historical data can be analysed to determine to what extent this is in fact true.

This is done as follows:

Let X_{ijt} denote the number of employees in industry i, occupation j in year t.

$X_{.jt}$ denote the number of employees in occupation j, year t.

$X_{..t}$ denote the total employment in year t.

O_{ijt} denote the proportion of all employees in industry i and year t that are in occupation j.

i.e., $O_{ijt} = X_{ijt}/X_{i.t}$

I_{it} denotes the proportion of all employees in year t that are in industry i.

i.e., $I_{it} = X_{i.t}/X_{..t}$

P_{jt} denote the proportion of all employees in year t that are in occupation j.

i.e., $P_{jt} = X_{.jt}/X_{..t}$

Let ΔP_j denote the change in the proportion of employees in occupation j between 1971 and 1981.

then

$$\Delta P_j = P_{j,81} - P_{j,71} \quad , \quad \text{note that} \quad \sum_{jt} \Delta P_{jt} = 0$$

For any year t,

$$P_{jt} = X_{.jt}/X_{..t}$$

But this can be expressed as

$$P_{jt} = \sum_i (X_{ijt}/X_{i.t} \;.\; X_{i.t}/X_{..t}) = \sum_i (O_{ijt} \;.\; I_{it})$$

Hence,

$$\Delta P_j = \sum_i (O_{ij81}\, I_{i81}) - \sum_i (O_{ij71}\, I_{i71})$$

but

$$O_{ij81} = O_{ij71} + \Delta O_{ij}$$

Hence,

$$\Delta P_j = \sum_i (O_{ij71} + \Delta O_{ij})\,(I_{i71} + \Delta I_i) - \sum_i O_{ij71}\, I_{71}$$

Multiplying out and collecting terms gives

$$\Delta P_j = \sum_i (O_{ij71}\, \Delta I_i) + \sum_i (\Delta O_{ij}\, I_{i,71}) + \sum_i (\Delta O_{ij}\, \Delta I_i)$$

We write this as

ΔP_j	=	ΔI_j	+	ΔO_j	+	ΔOI_j
Total change in the proportion of employment in occupation j.		Component due to change in mix of employment among industries.		Component due to change in occupational mix within industries.		Component due to changes in both, or an interaction term (usually very small).

Thus, the change in an occupation's share of total employment is decomposed into three components:

(1) component due to change in mix of employment among industries (denoted as ΔI_j).

(2) component due to change in occupational employment mix within industries (ΔO_j).

(3) an interaction term which is due to both factors above, (ΔOI_j). This interaction term is usually very small, since it is the product of two very small numbers.

Census data on the experienced labour force are readily available which allow the calculation of ΔP_j and the first component, ΔI_j, for each occupation j for the period 1971 to 1982.[6] It is this first component, ΔI_j, in which we are most interested. As noted above, the interaction term, ΔOI_j, is very small and approaches zero,[7] since it is the product of two very small numbers, which are ΔO_{ij}, the change in industry/occupation coefficients between census years, and ΔI_i, the change in an industry's share of employment. Thus, the difference between ΔP_j and ΔI_j is approximately equal to ΔO_j, the second component listed above.

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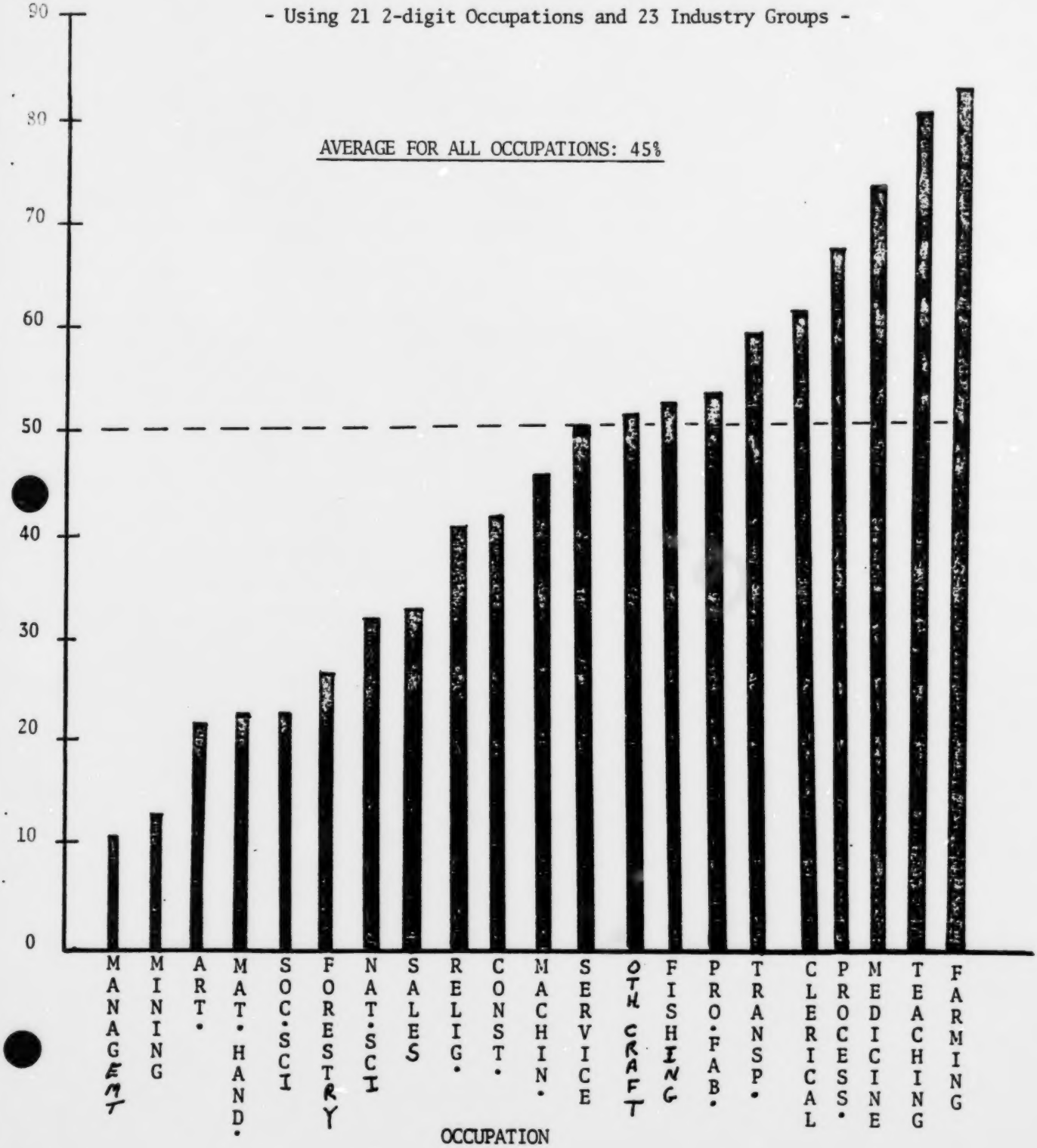
6 To estimate all three components requires a matrix of labour force data by industry and by occupation for all census years considered. These matrices would have to be compiled using the same industry and occupation coding system for all years. Unfortunately, the coding systems used change between census years. Industry/occupation matrices using the same coding systems for two or more census years are not readily available where a significant number of industry and occupation categories are used. Comparable data on the occupational distribution alone, and the industry distribution alone are available for 1971 and 1981, and these are comparable to the 1971 industry/occupation matrix. This represents sufficient comparable data to calculate ΔP_j and ΔI_j.

7 In an application of this technique to American data for the period 1962-75, at its largest ΔOI_j represented only 2% of the value of ΔP_j, and in most cases ΔOI_j was virtually zero. See Freeman, R.B., Manpower Requirements and Substitution Analysis of Labour Skills, in Research in Labour Economics, R.G. Ehrenburg, 1977, page 169.

CHART 2

PROPORTION OF AN OCCUPATIONS CHANGE IN SHARE OF EMPLOYMENT ATTRIBUTED TO CHANGE IN INDUSTRIAL MIX (1971-81)

- Using 21 2-digit Occupations and 23 Industry Groups -



The value of ΔP_j and ΔI_j are estimated for the 1971-81 period using two levels of aggregation for occupations and industries. In the first case, 21 occupations (2-digit CCDO) and 23 industry groupings are used (e.g., see industry/occupation matrix Table 13), and the second case employs 68 occupations (mainly 3-digit CCDO) and 56 industry groupings.

The results for case 1 are reported in Table 4 and Chart 2.

The major observations are:

(1) On <u>average</u>, 45% of the total change in an occupation's share of employment was attributable to changes in the industrial mix of employment during the 1971-81 period.

(2) There was enormous variation by occupation, ranging from the management/administrative occupation - where the changing industrial mix accounted for only 10% of the occupation's change in share - to the occupation of farming, where the changing industrial mix accounted for 84% of the occupation's change in share (Chart 2).

(3) The changing industrial mix factor (ΔI_j) accounted for <u>more</u> than 50% of the total change in the occupation's share in 9 of the 21 occupations. These were: 'other crafts', fishing/trapping, product fabricating, transportation equipment operators, clerical, processing, health occupations, teaching, and farming.

(4) The factor ΔI_j, accounted for <u>less</u> than 50% of the total change in the occupation's share (ΔP_j) in the 12 of the 21 occupations. These were: management/administration, natural sciences and engineering, social sciences, artistic occupations, sales, services, mining, material handling, forestry, religious occupations, construction trades, and machining.

(5) The larger an occupation's change in share of the labour force, the more important it is that an occupational projections model capture changes

Table 4: Decomposition of ΔP_i, The Change in Share of the Experienced Labour Force by Occupation, 1971-81

Occupation	ΔP_j $\times 10^2$	ΔI_j $\times 10^2$	ΔO_j* $\times 10^2$	$\left(\lvert \Delta I_j \rvert / \Delta \acute{P}_j\right) \times 100$**
Management/Admin.	2.32	.25	2.06	11%
Natural Science, Eng., Math	.50	.16	.34	32%
Social Sciences	.63	.15	.48	23%
Religion	-.02	.05	-.07	41%
Teaching	-.24	-.31	.07	81%
Medicine and Health	.32	.49	-.17	74%
Artistic, Literacy, Sports, etc.	.41	.09	.32	22%
Clerical	1.41	.88	.54	62%
Sales	-.52	.49	-1.01	33%
Services	-.02	1.25	-1.27	50%
Farming	-2.17	-1.83	-.34	84%
Fishing/Trapping	-.00	-.02	.02	53%
Forestry and Logging	-.16	-.04	-.11	27%
Mining	-.11	.02	-.13	13%
Processing Occns.	-.20	-.37	.17	68%
Machining and Related	-.43	-.20	-.23	46%
Product Fabricating, Repairing, etc.	-.06	-.38	.32	54%
Construction Trades	-.61	-.26	-.36	42%
Transportation Equipment Operations	-.37	-.22	-.15	60%
Material Handling	-.53	-.12	-.41	23%
Other Crafts and Equipment Operations	-.15	-.08	-.07	52%
Average For All Occupations				**45%**

* $\Delta O_j + \Delta OI_j$, obtained simply by subtracting ΔI_j from ΔP_j.

** Let the total movement in the occupation's share be defined as $\Delta \acute{P}_j = (\lvert \Delta I_j \rvert + \lvert \Delta Q_j \rvert)$. Then $(\lvert \Delta I_j \rvert / \Delta \acute{P}_j) \times 100$ represents the percent of the total movement in the share attributable to component 1, ΔI_j.

for that occupation. Thus, it is of interest to know if the "industrial mix factor", ΔI_j, accounts for a larger part of the total change in share when ΔP_j is large.

One way of determining this is to calculate a weighted average of $(|\Delta I_j|/\Delta \acute{P}_j)$, where the weight for a particular occupation is proportional to its change in share. When this is done, the proportion of the total occupational change in share attributable to the 'industrial mix factor', ΔI_j, remains at 45% on average.

(6) This relationship between the importance of ΔI_j and the size of ΔP_j is assessed in another way. There was no significant correlation[8] between the size of an occupation change in share (ΔP_j) and the proportion of the total change attributable to the industry mix factor i.e. ($|\Delta I_j|/\Delta \acute{P}_j$). That is, the "changing industry mix" factor did not tend to be more significant for occupations with large change in shares (such as management, farming, clerical, social sciences) than for those with small changes in share (such as fishing/trapping, services, religious occupations, and product fabricating/repairing).

The change in share of the labour force was decomposed into its two components for more detailed (68) occupations as well. In this case, industry/occupation matrix with 68 occupations and 56 industries was employed.

The findings are reported in Table 5, and the major observations are similar to those reported earlier.

(1) On average, 42% of the total change in the occupational mix ($\Delta \acute{P}_j$) of the labour force is attributable to changes in the industrial distribution of the labour force (ΔI_j) between 1971 and 1981. When a weighted average across occupations is calculated, where the weights are proportional to the magnitude of an occupation's change in share, the proportion of the change in $\Delta \acute{P}_j$ attributable to ΔI_j on average falls to 38%. This indicates that at this level of detail, ΔI_j tends to play a

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8 The correlation was .04.

Table 5: Decomposition of ΔP_j, the Change in Share of the Experienced Labour Force, by Detailed Occupation, 1971 to 1981

CCDO Code	Occupation	$\Delta P_j \times 10^2$	$\Delta I_j \times 10^2$	$\Delta O_j \times 10^2$	$\left(\lvert\Delta I_j\rvert / \Delta P_j\right) \times 100$
111.	Gov't Officials & Administrators	0.06	-0.02	0.08	19%
113/114.	Other Managers & Administrators	2.43	0.07	2.37	3%
117.	Occ. Related to Management & Admin.	-0.18	0.25	-0.43	37%
211.	Physical Sciences	-0.09	0.01	-0.10	6%
213.	Life Sciences	0.00	0.00	0.01	46%
214/215.	Architects & Engineers	0.20	0.07	0.13	37%
216.	Other Architecture & Engineering Occ.	0.13	0.09	0.05	64%
218.	Math./Statistics/System Analysis	0.25	0.01	0.24	4%
231.	Social Sciences	0.09	0.01	0.08	9%
233.	Social Work	0.33	0.05	0.27	16%
234.	Law/Jurisprudence	0.11	0.12	-0.01	92%
235.	Library/Museum/Archival Sc.	0.08	0.00	0.08	3%
239.	Other Social Sciences Occ.	0.02	0.00	0.03	8%
25.	Religion	-0.02	-0.03	0.01	82%
271.	University Teaching	0.05	-0.03	0.07	26%
273.	Elementary/Secondary Teaching	-0.52	-0.26	-0.26	50%
279.	Other Teaching Occ.	0.24	-0.02	0.26	6%
311.	Health Diagnosing & Treating	0.02	0.05	-0.04	61%
313.	Nursing/Therapy	0.10	0.38	-0.28	57%
315.	Medicine/Health	0.21	0.09	0.12	43%
33.	Artistic/Literary/Recreational	0.41	0.14	0.26	35%
411.	Stenographic/Typing	-0.15	0.41	-0.56	42%
413.	Bookkeeping/Account-recording	1.86	0.34	1.53	18%
414.	Office Machine/Electronic	0.19	0.03	0.17	15%
415.	Material Recording & Scheduling	0.15	-0.06	0.21	23%
416.	Library/File/Correspondence Clerks	-0.01	0.00	-0.01	11%
417.	Reception/Information/Mail/Message	0.07	0.12	-0.05	70%
419.	Other Clerical Occ.	-0.70	0.06	-0.76	8%
513/514.	Sales Occ., Commodities	-0.47	0.35	-0.82	30%
517.	Sales Occ., Services	0.12	0.24	-0.12	67%
519.	Other Sales Occ.	-0.16	-0.01	-0.15	7%
611.	Protective Service	-0.41	-0.07	-0.34	17%
612.	Food/Beverage Preparation	1.11	1.00	0.11	90%
613.	Lodging/Other Accommodation	-0.07	0.25	-0.31	44%
614.	Personal Service	-0.47	-0.37	-0.10	79%
616.	Apparel/Furnishings	-0.14	-0.07	-0.07	49%
619.	Other Service Occ.	-0.04	0.32	-0.36	47%
711.	Farmers	-1.05	-0.94	-0.11	89%
713.	Farm Management	0.06	-0.07	0.13	36%
718/719.	Other Farming Occ.	-1.18	-0.79	-0.39	67%
73.	Fishing/Hunting/Trapping	0.00	-0.01	0.01	60%
75.	Forestry/Logging	-0.16	-0.05	-0.11	30%
77.	Mining/Quarrying	-0.11	0.00	-0.10	2%
811.	Mineral Ore Treating	-0.01	-0.02	0.00	80%
813/814.	Metal Processing	0.08	-0.08	0.16	34%
815.	Clay/Glass/Stone Processing	-0.05	-0.03	-0.02	51%

Table 5: Decomposition of ΔP_j, the Change in Share of the Experienced Labour Force, by Detailed Occupation, 1971 to 1981 - Concluded -

CCDO Code	Occupation	$\Delta P_j \times 10^2$	$\Delta I_j \times 10^2$	$\Delta O_j \times 10^2$	$\left(\lvert \Delta I_j \rvert / \Delta P_j \right) \times 100$
816/817.	Chemicals/Petroleum/Rubber/Plastic	-0.01	-0.03	0.01	65%
821/822.	Food/Beverage Processing	-0.04	-0.15	0.11	58%
823.	Wood Processing	-0.01	0.01	-0.02	33%
825.	Pulp/Papermaking	-0.03	-0.08	0.05	62%
826/827.	Textile Processing	-0.09	-0.08	-0.01	90%
829.	Other Processing Occ.	-0.04	-0.03	-0.01	71%
831.	Metal Machining	-0.32	-0.08	-0.24	24%
833.	Metal Shaping & Forming	-0.03	-0.04	0.00	89%
835/839.	Wood/Clay/Glass/Stone/Other Machining	-0.08	-0.01	-0.07	14%
851/852.	Fabricating, etc., Metal Products	0.11	-0.06	0.17	26%
853.	Fabricating, etc., Electrical/Electronic	0.03	-0.06	0.09	41%
854.	Fabricating, etc., Wood Products	0.13	0.01	0.12	7%
855/856.	Fabricating, etc., Textiles/Fur/Leather	-0.19	-0.17	-0.01	93%
857.	Fabricating, etc., Rubber/Plastic	0.04	0.01	0.03	27%
858.	Mechanics/Repairers	-0.09	-0.05	-0.05	51%
859.	Other Fabricating Products Occ.	-0.08	-0.07	-0.02	81%
871.	Construction Trades	-0.08	-0.10	0.02	85%
873.	Electrical Power/Lighting, etc.	-0.09	0.02	-0.11	15%
878/879.	Other Construction Trades Occ.	-0.44	-0.13	-0.31	30%
91.	Transport Equipment Operating	-0.37	-0.25	-0.13	66%
93.	Material Handling	-0.53	-0.15	-0.39	28%
95.	Other Crafts & Equipment Operating	-0.15	-0.04	-0.11	28%
	Average Over All Occupations				**42%**

See footnotes on Table 4.

slightly less significant role for occupations with large changes in share than for those with smaller changes in share.

(2) As before, there is enormous variation by occupations with the industrial mix factor accounting for 2% of the change in share for occupation 77 (CCDO code) (mining and quarrying occupations) to 93% for occupation 855/856 (textile, fur and leather products assembling occupations).

(3) Dividing the occupations into three groups, it is found that ΔI_j accounts for between 0 and one-third of the change in occupational share for 43% of the occupations, from 1/3 to 2/3 for 33% of the occupations, and from 2/3 to all of the change in share for 24% of the occupations.

(4) If one picks particular kinds of occupations, the importance of the 'industrial mix factor' can vary. For example, among the highly qualified manpower occupations[9] - those that college and university graduates tend to enter - the industrial mix factor accounted for, on average, only 31% of the change in share of the occupations between 1971 and 1981. Thus, fixed coefficient models would have been less useful for this group of occupations than for occupations as a whole during the 1970s.

On the other hand, in the '800 series' blue collar occupations (processing, machining, product fabricating, assembling, repairing, and construction trades) the industrial mix factor accounted for 51% of the change in the share of the occupations on average.

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[9] Primarily those in groups 21, 23, 25, 27, 31, 33 and some occupations in group 11.

Conclusion

This paper has examined the extent to which changes in occupational shares of employment are attributable to changes in the industrial structure of employment. Put another way, to what degree would fixed coefficient occupational requirements models have tracked changes in employment in occupations during the 1970s if accurate data on total employment by industry had been available as input to the model.

The findings can be summarized as follows:

1. In general, the fixed-coefficients approach would have provided a somewhat useful fix on changes in employment among occupations, accounting for between 38% and 45% of the change in the share of employment by occupation (assuming zero error in the total employment by industry on which the estimates of employment by occupation are based).

2. These findings are very similar to those of an earlier study by Freeman (1980) on the applicability of the fixed coefficients approach in the United States between 1960 and 1970. He found that such a model would have captured 44%[10] of the change in employment by occupation during that period.

3. The model would have worked much better for some occupations than others. For example, very little of the large shift in employment towards the management/administrative occupation would have been captured, while the majority of the large shift away from farming occupation would have been noted.

4. In general, changes in occupational employment levels were dictated by the changing industrial structure to a greater degree for the service and blue collar occupations than for the white collar (highly qualified and

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10 i.e., 44% of the changes in the log of employment, weighted by the size of occupation. R.B. Freeman, "An Empirical Analysis of the Fiscal Coefficients Manpower Requirements Model", 1960-1970, The Journal of Human Resources, Volume XV, #2, Winter 1980, page 197.

clerical) occupations. Put another way, the 'industrial mix factor', ΔI_j, accounted for a larger proportion of the total occupational change in share, ΔP_j, for occupations in the second part of the CCDO coding system than for those in the first part. For example, among the 28 occupations in groups 11 to 41, only in 7 (or 25%) did ΔI_j represent more than 50% of ΔP_j. Among the 40 occupations in groups 51 to 95, ΔI_j accounted for more than half of ΔP_j for 20 (or 50%) of the occupations.

There are some exceptions to this general statement. Among highly qualified manpower occupations, the employment changes in teaching (concentrated in the education sector) and medical occupations (concentrated in the health sector) were dictated largely by employment changes in the related sectors. In the blue collar occupations, changes in employment levels in mining and material handling occupations were dictated largely by intra-industry changes in the occupational mix. This could perhaps reflect changes in technology and production process utilizing these occupations, leading to a change between 1971 and 1981 in the industry/occupation coefficients involving these occupations.

5. What of the 1980s? Are fixed-coefficient occupational requirements models likely to be more or less useful than in the 1970s. Or, more narrowly defined, the question is whether the 'industry mix factor' (ΔIj) will play a larger or smaller role in determining changes in occupational shares (ΔP_j).

There are three basic conditions which determine the usefulness of a model employing a fixed-coefficient methodology to convert employment requirements by industry to employment requirements by occupation. They are:

(1) the magnitude of the change in the industrial mix of employment (or industrial structure),
(2) the degree of dissimilarity <u>among industries</u> in the types of occupations utilized in them, and,

(3) the time-variance of the industry/occupation matrix (i.e., the extent to which occupational distributions within industries remain fixed).

The effects of these three factors can be examined using the basic equation on page 11. In a fixed-coefficient model, ΔO_{ij} is assumed to be zero, and thus

$$\Delta P_j \overset{\text{is assumed}}{=} \sum_i O_{ij} \Delta I_i$$

Looking at the <u>first factor</u> listed above, the change in the industrial mix of employment, if manpower demand (employment) in all industries grew at the same rate, then ΔI_i would be zero for all i, rendering ΔP_j zero. Thus the <u>share</u> of the total manpower demand would remain the same for all occupations, and the model would contribute no new information. This is, of course, a highly unlikely prospect. Conversely, the larger the <u>variation</u> in the manpower demand among industries the more useful the model.

The <u>second factor</u> which influences usefulness of the model is the degree of <u>dissimilarity</u> in the occupation mix <u>within</u> industries.

Examining the previous equation, it can be seen that if the occupation coefficients (i.e., percent distributions) within all occupations were the same, then ΔP_j would again be zero, and the model again would have provided no new information.

$$\text{i.e., } P_j = \sum_i O_{ij} \Delta I_i = O_j \sum_i I_i = 0$$

Conversely the greater the dissimilarity in the occupational coefficient distributions (O_{ij}) among the industries, the more useful the information provided by the fixed-coefficients requirements model.

This implies, for example, that one should choose a level of aggregation of the occupation and industry variables that <u>maximizes</u> the dissimilarity of the occupational distributions within industries.

The optimal case is where there is an exact match between occupations and industries (again a highly unlikely state). In this case, all diagonals in the matrix would be 1.0, all other entries 0. Here, the change in the share in demand by occupation would be exactly equal to the change in share in the demand for the industry to which it was matched. The further one moves away from the configuration, the less valuable the model.

The importance of the third factor, the time-invariance of the industry/occupation matrix coefficients, is obvious, since it is assumed in the model that this is zero. The greater the change in the occupational distributions within industries, the less valuable the model in tracking changes in occupation employment levels.

Given these three factors, what of the 1980s? Concerning factor one, it was shown earlier that the magnitude of the change in the industrial mix of employment has been much greater during the early 1980s than during the 1970s. This is largely due to the 1981-82 recession, and the fact that some sectors have not returned to the levels of employment observed before 1981. Whether this rapid pace of industrial restructuring of employment will continue is anyone's guess. But to date, this rapid change would tend to make fixed-coefficient models more useful in tracking occupational change in the 1980s than in the 1970s, all other things (i.e., factors two and three) being equal.

Concerning factor two - the degree of dissimilarity among industries in their occupational distributions - there is really no reason to assume that this has changed dramatically since the 1970s. This could be examined if comparable industry/occupation coefficients were available for 1971 and 1981, but such data are not readily available to the author.

Factor three, the change over time in the occupational distributions within industries, also requires comparable industry/occupation matrices to be examined, and these certainly are not available for any period since the recession. It is quite possible that the recession and its

aftermath introduced considerable change to the occupational mix within some industries, particularly those in the goods-producing sector hardest hit by the recession. Workers in some occupations (semi-skilled and unskilled blue collar) may have been let go at proportionally higher rates than some professional and technical occupations (the labour hoarding hypothesis). Those in the latter occupations are more expensive to rehire or retrain. Technological change and the drive to increase productivity may also lead to a decline in semi-skilled and unskilled workers share of employment in these industries. Although this is all speculation, it does suggest that one should be cautious in assuming that the 1981 Census industry/occupation matrix will be representative of the 1980s and early 1990s.

Overall, it is clear that the relative stability in employment trends and patterns of the 1970s has been replaced in the early 1980s by sometimes dramatic changes, caused largely by the recession and its aftermath. Data on employment patterns before 1981 should be used cautiously if they are assumed to be representative of the employment patterns in the mid to late 1980s. However, the rapid industrial restructuring which has taken place since 1981 suggests fixed-coefficient models may be useful in tracking employment trends by occupation in the 1980s.

APPENDIX
BACKGROUND DATA

Table 6: Industries Included in the Major Sectors

The economy is divided into two main components, the goods-producing and the service sector. The service sector is subdivided into commercial and non-commercial (or public) services. Commercial services, the largest sector of the economy, is further subdivided into three parts: distributive, producer, and consumer services. Non-commercial services refers to "not for-profit" organizations, which are largely financed directly by government.

Following is a list of the industries included in each sector:

GOODS-PRODUCING SECTOR: agriculture, manufacturing, construction, mining/oil and gas wells, utilities, forestry and fishing (SIC 001 to 421, and 572 to 579).

SERVICE SECTOR

Commercial Services

distributive services: transportation and storage, communication, wholesale and retail trade (SIC 501 to 548, 602 to 699).

consumer services: accommodation and food services, personal services, amusement and recreational services, miscellaneous services (SIC 841 to 849, 871 to 899).

producer services: services to business management (e.g., accounting, engineering, legal and management consulting firms), finance, insurance and real estate (SIC 701 to 737, 851 to 869).

Non-commercial Services: education, health and welfare services, religious organizations, public administration (government) (SIC 801 to 831, 902 to 991).

Table 7: Experienced Labour Force by INDUSTRY, 1951 to 1981

Industry	Percent Distribution				Change in Share of Experienced Labour Force		
	1951	1961	1971	1981	1951 1961	1961 1971	1971 1981
Agriculture	15.6	9.9	5.8	4.1	-5.7	-4.0	-1.7
Forestry	2.5	1.7	0.9	0.9	-0.8	-0.8	-0.1
Fishing and Trapping	1.0	0.6	0.3	0.3	-0.4	-0.3	.0
Mines, Oil and Gas Wells	2.0	1.8	1.8	1.8	-0.1	-0.1	0.1
Food and Beverage	3.3	3.5	3.0	2.6	0.1	-0.4	-0.4
Tobacco Products	0.2	0.1	0.1	0.1	.0	.0	.0
Rubber and Plastic Products	0.4	0.4	0.6	0.6	.0	0.2	.0
Leather Industries	0.6	0.5	0.4	0.3	-0.1	-0.2	-0.1
Textile Industries	1.5	0.9	0.9	0.7	-0.5	-0.1	-0.2
Knitting Mills	0.5	0.3	0.2	0.2	-0.1	-0.1	.0
Clothing Industries	1.6	1.4	1.2	1.1	-0.2	-0.2	-0.1
Wood Industries	2.2	1.6	1.3	1.3	-0.6	-0.3	.0
Furniture and Fixture	0.6	0.6	0.6	0.6	.0	.0	.0
Paper and Allied	1.7	1.6	1.5	1.3	-0.1	.0	-0.3
Printing, Publishing and Allied	1.2	1.3	1.3	1.2	0.1	.0	-0.1
Primary Metal	2.4	1.4	1.4	1.2	-1.0	.0	-0.3
Metal Fabricating (except Machinery and Transportation Equipment)	..	1.6	1.7	1.6	..	0.1	-0.1
Machinery (except Electrical Machinery)	..	0.8	1.0	1.0	..	0.2	0.1
Transportation Equipment	2.4	1.9	2.0	1.8			
Electrical Products	..	1.3	1.4	1.1	-0.6	0.2	-0.2
Non-metallic Mineral Products	0.7	0.7	0.7	0.6	..	0.1	-0.3
Petroleum, Coal, Chemical and Chemical Products	1.2	1.4	1.2	1.1	0.1	.0	-0.1
Misc. Manufacturing Industries	0.8	0.8	0.8	0.7	0.1	-0.1	-0.1
					.0	.0	-0.1
Construction	6.2	6.9	6.7	6.5	0.8	-0.2	-0.3
Transportation and Storage	7.0	6.3	5.3	4.8	0.7	-1.0	-0.5
Communication	1.8	2.1	2.0	2.1	-0.2	.0	0.1
Electric Power, Gas and Water Utilities	1.2	1.2	1.1	1.1	.0	-0.1	.0
Wholesale Trade	4.5	4.8	4.4	4.8	0.3	-0.4	0.4
Retail Trade	10.0	11.1	11.7	12.1	1.0	0.6	0.4
Financial Institutions	1.3	1.8	2.3	2.7	0.4	0.5	0.4
Insurance and Real Estate	1.4	1.9	2.2	2.6	0.4	0.3	0.4
Education and Related	2.9	4.3	7.0	6.6	1.3	2.8	-0.4
Health and Welfare	3.4	4.9	6.5	7.3	1.6	1.6	0.8
Religious Organizations	0.8	0.9	0.7	0.6	0.1	-0.2	-0.1
Amusement and Recreation	0.6	0.7	1.0	1.2	0.1	0.3	0.2
Services to Business Management and Misc. Services	1.7	2.7	4.3	6.3	1.0	1.6	2.0
Personal Services	3.1	3.1	2.2	1.6	.0	-0.9	-0.6
Accommodation and Food	3.1	3.9	4.4	5.8	0.8	0.6	1.4
Federal Administration	3.5	4.5	4.1	3.3	1.0	-0.4	-0.8
Provincial Administration	0.7	1.1	2.0	2.2	0.4	0.9	0.2
Local Administration	1.0	1.9	1.8	2.0	0.8	-0.1	0.3
Other Government Offices	0.1	0.1	.0	.0	.0	-0.1	.0
TOTAL (%)	100.0[2]	100.0	100.0	100.0	-	-	-
TOTAL NUMBER (000's)	5286.4	6471.8	8626.9	12005.3			

".." data not available.
[1] The unclassified industries have been redistributed for all years using the assignment distribution developed for the 1981 Census. All years based on 1970 SIC (Standard Industrial Classification Manual).
[2] The sum of the figures in the 1951 column does not add to the total because of missing industries.

Source: Census of Canada.

Table 8: Employment by INDUSTRY, 1976, 1981 and 1984 Annual Averages

Industry	Percent Distribution			Change in Share	
	1976	1981	1984	1976 1981	1981 1984
Agriculture	5.0	4.4	4.3	-0.6	-0.1
Forestry	0.7	0.7	0.7	.0	.0
Fishing and Trapping	0.2	0.3	0.3	0.1	.0
Mines, Oil and Gas Wells	1.5	1.9	1.7	0.4	-0.2
Food and Beverage	2.6	2.4	2.2	-0.2	-0.2
Tobacco Products	0.1	0.1	.0	.0	-0.1
Rubber and Plastic Products	0.6	0.6	0.7	.0	0.1
Leather Industries	0.3	0.3	0.3	.0	.0
Textile Industries	0.7	0.6	0.5	-0.1	-0.1
Knitting Mills	0.2	0.2	0.1[1]	.0	-0.1
Clothing Industries	1.2	1.1	1.1[1]	.0	.0
Wood Industries	1.2	1.3	1.1	.0	-0.2
Furniture and Fixture	0.6	0.6	0.6	.0	.0
Paper and Allied	1.5	1.3	1.2	-0.2	-0.1
Printing, Publishing and Allied	1.2	1.2	1.3	.0	0.1
Primary Metal	1.4	1.4	1.1	.0	-0.3
Metal Fabricating (except Machinery and Transportation Equipment)	1.6	1.6	1.3	0.1	-0.3
Machinery (except Electrical Machinery)	1.1	1.1	0.7	0.1	-0.4
Transportation Equipment	2.0	1.8	1.9	-0.2	0.1
Electrical Products	1.4	1.2	1.5	-0.1	0.3
Non-metallic Mineral Products	0.7	0.6	0.5	-0.1	-0.1
Petroleum, Coal, Chemical and Chemical Products	1.2	1.1	1.1	-0.1	.0
Misc. Manufacturing Industries	0.7	0.7	0.7	.0	.0
General Contractors	3.0	2.4	2.1	-0.6	-0.3
Special-trade Contractors	3.7	3.5	3.1	-0.2	-0.4
Transportation and Storage	5.2	4.9	4.4	-0.3	-0.5
Communication	2.3	2.2	2.3	-0.1	0.1
Electric Power, Gas and Water Utilities	1.2	1.2	1.1	.0	-0.1
Wholesale Trade	4.7	4.5	4.4	-0.2	-0.1
Retail Trade	12.7	12.6	13.1	-0.1	0.5
Finance Industries	2.6	2.7	2.9	0.1	0.2
Insurance Carriers	1.0	1.1	1.1	0.1	.0
Insurance Agencies and Real Estate	1.6	1.6	1.8	.0	0.2
Education and Related	7.0	6.5	6.7	-0.5	0.2
Health and Welfare	7.3	7.7	8.5	0.3	0.8
Religious Organizations	0.6	0.6	0.8	.0	0.2
Amusement and Recreation	1.0	1.2	1.1	0.2	-0.1
Services to Business Management	3.1	4.1	4.1	0.9	.0
Personal Services	2.1	2.5	2.7	0.4	0.2
Accommodation and Food	4.3	5.4	5.5	1.1	0.1
Miscellaneous Services	1.7	1.9	2.2	0.2	0.3
Federal Administration	2.9	2.6	2.6	-0.3	.0
Provincial Administration	2.1	2.3	2.3	0.1	.0
Local Administration and Other Government Offices	2.1	2.1	2.3	.0	0.2
TOTAL (%)	100.0	100.0	100.0	-	-
TOTAL NUMBER (000's)	9477	11006	11000		

[1] The clothing and knitting mills industries were combined in 1984, with a total employment of 134,000. The split between these two industries for 1984 was estimated.

Source: Labour Force Survey.

Table 9: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Occupation

CCDO Code	Occupation	Percent Distribution		Change in Share 1971 to 1981
		1971	1981	
11.	Management/Administration	4.82	7.14	2.31
21.	Natural Science/Engineering/Math.	3.03	3.53	0.50
23.	Social Sciences	1.02	1.65	0.63
25.	Religion	0.31	0.28	-0.02
27.	Teaching	4.52	4.29	-0.24
31.	Medicine/Health	4.23	4.55	0.32
33/37.	Artistic/Literacy/Sports, etc.	1.04	1.45	0.41
41.	Clerical	17.79	19.20	1.41
51.	Sales	10.56	10.05	-0.52
61.	Services	12.56	12.54	-0.02
71.	Farming	6.63	4.46	-2.17
73.	Fishing/Trapping	0.35	0.35	0.00
75.	Forestry/Logging	0.87	0.71	-0.16
77.	Mining	0.77	0.66	-0.11
81/82.	Processing Occup.	4.33	4.14	-0.20
83.	Machinery and Related	3.12	2.69	-0.43
85.	Prod. Fabricating/Repairing, etc.	8.21	8.16	-0.06
87.	Construction Trades	7.36	6.75	-0.62
91.	Transportation Equip. Op.	4.38	4.01	-0.37
93.	Material Handling	2.67	2.13	-0.53
95.	Other Crafts/Equip. Op.	1.41	1.26	-0.15

Note: Both 1971 and 1981 data are coded using the 1970 SOC.

Table 10: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Detailed Occupation

CCDO Code	Occupation	Percent Distribution		Change in Share
		1971	1981	1971 to 1981
111.	Gov't Officials & Administrators	0.51	0.57	0.06
113/114.	Other Managers & Administrators	1.87	4.31	2.43
117.	Occ. Related to Management & Admin.	2.44	2.26	-0.18
211.	Physical Sciences	0.44	0.36	-0.09
213.	Life Sciences	0.25	0.25	0.00
214/215.	Architects & Engineers	1.05	1.25	0.20
216.	Other Architecture & Engineering Occ.	0.95	1.09	0.13
218.	Math./Statistics/System Analysis	0.34	0.59	0.25
231.	Social Sciences	0.15	0.24	0.09
233.	Social Work	0.40	0.72	0.33
234.	Law/Jurisprudence	0.27	0.38	0.11
235.	Library/Museum/Archival Sc.	0.13	0.21	0.08
239.	Other Social Sciences Occ.	0.07	0.10	0.02
25.	Religion	0.31	0.28	-0.02
271.	University Teaching	0.34	0.39	0.05
273.	Elementary/Secondary Teaching	3.52	3.00	-0.52
279.	Other Teaching Occ.	0.66	0.90	0.24
311.	Health Diagnosing & Treating	0.51	0.53	0.02
313.	Nursing/Therapy	3.02	3.12	0.10
315.	Medicine/Health	0.70	0.91	0.21
33.	Artistic/Literary/Recreational	1.04	1.45	0.41
411.	Stenographic/Typing	4.37	4.22	-0.15
413.	Bookkeeping/Account-recording	4.65	6.52	1.86
414.	Office Machine/Electronic	0.67	0.87	0.19
415.	Material Recording & Scheduling	2.02	2.16	0.15
416.	Library/File/Correspondence Clerks	0.46	0.45	-0.01
417.	Reception/Information/Mail/Message	2.00	2.07	0.07
419.	Other Clerical Occ.	3.61	2.91	-0.70
513/514.	Sales Occ., Commodities	8.83	8.36	-0.47
517.	Sales Occ., Services	1.27	1.39	0.12
519.	Other Sales Occ.	0.47	0.30	-0.16
611.	Protective Service	2.64	2.22	-0.41
612.	Food/Beverage Preparation	3.56	4.66	1.11
613.	Lodging/Other Accommodation	0.80	0.73	-0.07
614.	Personal Service	1.94	1.48	-0.46
616.	Apparel/Furnishings	0.51	0.37	-0.14
619.	Other Service Occ.	3.12	3.08	-0.04
711.	Farmers	3.03	1.98	-1.05
713.	Farm Management	0.26	0.31	0.06
718/719.	Other Farming Occ.	3.35	2.17	-1.18
73.	Fishing/Hunting/Trapping	0.35	0.35	0.00
75.	Forestry/Logging	0.87	0.71	-0.16
77.	Mining/Quarrying	0.77	0.66	-0.11
811.	Mineral Ore Treating	0.09	0.08	-0.01
813/814.	Metal Processing	0.56	0.64	0.08
815.	Clay/Glass/Stone Processing	0.22	0.17	-0.05

Table 10: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Detailed Occupation - Concluded -

CCDO Code	Occupation	Percent Distribution		Change in Share 1971 to 1981
		1971	1981	
816/817.	Chemicals/Petroleum/Rubber/Plastic	0.41	0.40	-0.01
821/822.	Food/Beverage Processing	1.59	1.55	-0.04
823.	Wood Processing	0.47	0.46	-0.01
825.	Pulp/Papermaking	0.43	0.40	-0.03
826/827.	Textile Processing	0.45	0.36	-0.09
829.	Other Processing Occ.	0.10	0.06	-0.04
831.	Metal Machining	1.14	0.82	-0.32
833.	Metal Shaping & Forming	1.53	1.50	-0.03
835/839.	Wood/Clay/Glass/Stone/Other Machining	0.45	0.37	-0.08
851/852.	Fabricating, etc., Metal Products	0.72	0.83	0.11
853.	Fabricating, etc., Electrical/Electronic	1.07	1.10	0.03
854.	Fabricating, etc., Wood Products	0.27	0.40	0.13
855/856.	Fabricating, etc., Textiles/Fur/Leather	1.84	1.66	-0.19
857.	Fabricating, etc., Rubber/Plastic	0.28	0.32	0.04
858.	Mechanics/Repairers	3.19	3.09	-0.09
859.	Other Fabricating Products Occ.	0.84	0.75	-0.08
871.	Construction Trades	1.09	1.01	-0.08
873.	Electrical Power/Lighting, etc.	1.29	1.20	-0.09
878/879.	Other Construction Trades Occ.	4.98	4.53	-0.44
91.	Transport Equipment Operating	4.38	4.01	-0.37
93.	Material Handling	2.67	2.13	-0.53
95.	Other Crafts & Equipment Operating	1.41	1.26	-0.15

Note: Both 1971 and 1981 data are coded using the 1970 SOC.

Table 11: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Industry

Industry	Percent Distribution		Change in Share 1971 to 1981
	1971	1981	
Agriculture	6.06	4.15	-1.91
Forestry/Fishing/Trapping	1.26	1.19	-0.07
Mines	1.75	1.81	0.06
Food/Bev./Tobacco/Rubber/Leather	4.09	3.58	-0.51
Textiles/Knitting Mills/Clothing	2.29	1.97	-0.32
Wood/Furniture/Fixture	1.82	1.90	0.07
Paper/Allied/Printing	2.86	2.44	-0.42
Primary Metals/Metal Fab.	3.18	2.83	-0.35
Machinery/Transportation Equip.	3.04	2.84	-0.20
Electrical Prod./Non-Met. Mineral	2.18	1.75	-0.42
Petroleum/Coal/Chemical Prod.	1.24	1.09	-0.15
Miscellaneous Manufacturing	.78	0.73	-0.06
Construction	6.77	6.49	-0.29
Transport/Storage	5.29	4.80	-0.48
Communication/Utilities	3.16	3.26	0.10
Wholesale Trade	4.39	4.81	0.42
Retail Trade	11.59	12.06	0.47
Finance/Insurance/Real Estate	4.51	5.35	0.85
Education and Related	7.17	6.62	-0.54
Health/Welfare	6.46	7.34	0.88
Services to Business Management	2.63	4.14	1.52
Consumer Services[1]	9.44	11.20	1.76
Public Administration	8.05	7.64	-0.41

Note: Both 1971 and 1981 data are coded using the 1970 SIC.

[1] Includes accommodation and food services, personal services, amusement and recreational services, and miscellaneous services.

Table 12: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Detailed Industry

Industry	Percent Distribution		Change in Share
	1971	1981	1971 to 1981
Agriculture	6.06	4.15	-1.91
Forestry	0.94	0.87	-0.07
Fishing/Trapping	0.32	0.32	0.00
Metal Mines	0.86	0.68	-0.18
Mineral Fuels	0.37	0.53	0.17
Non-Metal Mines	0.20	0.16	-0.04
Quarries/Sand Pits	0.09	0.08	-0.01
Services Incidental to Mining	0.24	0.36	0.12
Food/Beverage	3.05	2.64	-0.41
Tobacco Products	0.11	0.07	-0.04
Rubber/Plastic Products	0.57	0.60	0.03
Leather	0.36	0.28	-0.08
Textile	0.87	0.70	-0.17
Knitting Mills	0.23	0.19	-0.04
Clothing	1.19	1.08	-0.11
Wood	1.27	1.30	0.03
Furniture/Fixture	0.56	0.60	0.04
Paper/Allied	1.56	1.26	-0.30
Printing/Publishing/Allied	1.30	1.18	-0.13
Primary Metal	1.47	1.19	-0.28
Metal Fabricating	1.71	1.64	-0.07
Machinery	0.98	1.05	0.07
Transportation Equipment	2.07	1.80	-0.27
Electrical Products	1.47	1.15	-0.32
Non-Metallic Mineral	0.70	0.60	-0.10
Petroleum/Coal Products	0.25	0.23	-0.02
Chemical/Chemical Products	0.99	0.86	-0.13
Miscellaneous Manufacturing	0.78	0.73	-0.06
General Contractors	3.34	2.67	-0.66
Special-Trade Contractors	3.44	3.81	0.37
Transportation	5.08	4.61	-0.47
Storage	0.21	0.19	-0.01
Communication	2.05	2.14	0.08
Utilities	1.11	1.12	0.02
Wholesale Trade	4.39	4.81	0.42
Retail Trade			
Food Stores	2.35	2.36	0.01
General Merchandise	2.95	2.56	-0.39
Tire/Batteries/Accessories	0.27	0.36	0.09
Gasoline Service Stations	0.94	0.74	-0.20
Motor Vehicle Dealers	0.83	0.84	0.00
Motor Vehicle Repair Shops	0.76	0.84	0.08
Other Retail Trade	3.48	4.37	0.88
Finance	2.33	2.74	0.41
Insurance Carriers	0.89	0.88	-0.01

Table 12: Change in Share of the Experienced Labour Force Between 1971 and 1981, by Detailed Industry - Concluded

Industry	Percent Distribution		Change in Share 1971 to 1981
	1971	1981	
Insurance Agencies/Real Estate	1.28	1.73	0.44
Education and Related	7.17	6.62	-0.54
Health/Welfare	6.46	7.34	-0.88
Religious Organizations	0.59	0.53	-0.07
Amusement/Recreation	0.94	1.18	0.23
Services to Business Management	2.63	4.14	1.52
Personal Services	2.25	1.58	-0.67
Accommodation/Food	4.17	5.75	1.58
Miscellaneous Services	1.48	2.17	0.68
Federal Administration	4.14	3.33	-0.81
Provincial Administration	2.03	2.25	0.22
Local and Other Gov't Offices	1.88	2.06	0.19

Note: Both 1971 and 1981 data are coded using the 1970 SIC.

Table 13: Industry/Occupation Matrix, 1971

Industry	Occupation										
	Management Admin.	Natural Sc./Eng./ Math.	Social Sciences	Religion	Teaching	Medicine/ Health	Artistic/ Literacy/ Sports, etc.	Clerical	Sales	Services	Farming
	Percent										
Agriculture	0.12	0.18	0.01	0.02	0.00	0.42	0.04	0.67	0.32	0.34	96.64
Forestry/Fishing/Trapping	1.06	2.55	0.03	0.02	0.02	0.11	0.10	3.04	0.32	2.72	1.13
Mines	4.46	10.38	0.22	0.00	0.09	0.28	0.09	9.68	0.76	2.19	0.42
Food/Bev./Tobacco/Rubber/Leather	3.86	1.68	0.08	0.00	0.03	0.14	0.13	13.43	13.29	2.84	0.70
Textiles/Knitting Mills/Clothing	3.03	1.07	0.06	0.00	0.05	0.07	0.95	11.08	4.37	4.32	0.02
Wood/Furniture/Fixture	2.92	0.88	0.04	0.00	0.01	0.17	0.31	8.05	3.06	2.49	0.10
Paper/Allied/Printing	4.29	2.49	0.14	0.01	0.04	0.15	4.44	16.76	8.72	1.94	0.06
Primary Metals/Metal Fab.	4.14	4.99	0.10	0.00	0.03	0.15	0.24	12.92	3.23	1.97	0.05
Machinery/Transportation Equip.	4.32	6.13	0.16	0.00	0.08	0.16	0.33	15.35	3.83	2.09	0.07
Electrical Prod./Non-Met. Mineral	5.17	8.59	0.16	0.00	0.09	0.13	0.46	16.77	4.72	1.48	0.06
Petroleum/Coal/Chemical Prod.	7.65	10.23	0.40	0.00	0.05	0.91	0.33	21.30	11.09	2.51	0.20
Miscellaneous Manufacturing	5.80	4.41	0.11	0.00	0.10	3.91	2.88	19.39	8.65	1.50	0.06
Construction	3.21	2.29	0.02	0.00	0.01	0.04	0.12	5.76	1.24	1.23	2.06
Transport/Storage	2.69	2.08	0.15	0.00	0.18	0.13	0.11	16.18	1.55	5.16	0.25
Communication/Utilities	6.30	7.34	0.31	0.00	0.30	0.07	3.92	45.73	1.72	2.22	0.26
Wholesale Trade	6.71	1.32	0.12	0.00	0.05	0.11	0.24	28.18	31.42	1.02	0.73
Retail Trade	1.80	0.18	0.03	0.00	0.06	1.08	0.68	19.25	50.37	3.75	0.14
Finance/Insurance/Real Estate	13.35	1.49	0.40	0.00	0.07	0.12	0.18	51.77	23.68	5.92	0.20
Education and Related	6.39	2.54	2.47	0.16	59.42	1.06	0.60	12.73	0.28	10.17	0.50
Health/Welfare	2.29	0.59	3.14	0.20	1.13	57.02	0.11	14.03	0.27	18.10	0.22
Services to Business Management	15.79	18.90	8.50	0.01	0.09	0.40	3.22	35.63	3.27	8.37	0.10
Consumer Services	2.40	0.30	0.95	2.91	0.46	0.44	3.92	9.34	3.49	66.18	1.67
Public Administration	11.14	7.00	3.13	0.05	1.13	1.78	1.02	28.51	0.62	29.89	2.07

Table 13: Industry/Occupation Matrix, 1971 - Concluded -

Industry	Occupation										
	Fishing/ Trapping	Forestry/ Logging	Mining	Process- sing Occup.	Machinery and Related	Prod. Fabrica- ting/ Repairing, etc.	Construc- tion Trades	Trans- portation Equip. Op.	Material Handling	Other Crafts/ Equip. Op.	Total
	Percent										
Agriculture	0.01	0.09	0.00	0.34	0.03	0.10	0.15	0.28	0.22	0.02	100%
Forestry/Fishing/Trapping	23.07	47.80	0.27	2.15	1.55	2.78	2.10	5.54	3.39	0.27	100%
Mines	0.03	0.09	36.78	5.38	3.39	8.23	6.07	5.63	3.95	1.90	100%
Food/Bev./Tobacco/Rubber/Leather	1.18	0.01	0.01	32.32	1.51	13.59	0.96	3.79	9.23	1.21	100%
Textiles/Knitting Mills/Clothing	0.01	0.01	0.01	19.54	1.01	49.82	0.56	0.51	2.59	0.91	100%
Wood/Furniture/Fixture	0.01	4.32	0.07	24.73	10.39	24.01	5.60	2.62	9.25	1.01	100%
Paper/Allied/Printing	0.00	1.65	0.02	15.62	2.50	12.12	2.79	2.00	4.44	19.81	100%
Primary Metals/Metal Fab.	0.01	0.02	0.66	15.89	31.25	10.37	5.37	1.82	5.71	1.09	100%
Machinery/Transportation Equip.	0.01	0.02	0.05	2.11	22.63	33.08	4.51	1.33	3.14	0.58	100%
Electrical Prod./Non-Met. Mineral	0.00	0.00	0.23	9.15	10.06	27.09	6.79	3.65	4.43	0.97	100%
Petroleum/Coal/Chemical Prod.	0.00	0.01	0.49	19.53	2.74	5.88	3.61	2.91	7.45	2.70	100%
Miscellaneous Manufacturing	0.01	0.01	0.04	4.15	11.46	28.10	2.27	0.99	3.84	2.30	100%
Construction	0.00	0.18	0.85	0.57	4.22	3.49	6.84	3.80	2.19	0.33	100%
Transport/Storage	0.00	0.16	0.11	0.36	1.51	7.76	8.95	44.25	7.52	0.92	100%
Communication/Utilities	0.00	0.20	0.12	0.14	0.74	4.03	17.44	2.01	2.10	5.05	100%
Wholesale Trade	0.09	0.21	0.07	2.48	2.47	9.09	2.10	7.39	5.73	0.46	100%
Retail Trade	0.01	0.01	0.00	2.38	0.27	14.25	0.70	2.14	2.76	0.15	100%
Finance/Insurance/Real Estate	0.00	0.02	0.02	0.23	0.35	0.50	0.80	0.26	0.23	0.41	100%
Education and Related	0.00	0.01	0.00	0.08	0.14	0.44	1.08	1.28	0.06	0.58	100%
Health/Welfare	0.00	0.00	0.00	0.33	0.11	0.64	0.71	0.27	0.11	0.73	100%
Services to Business Management	0.00	0.05	0.27	0.39	0.47	1.14	1.47	0.90	0.38	0.64	100%
Consumer Services	0.01	0.03	0.01	0.45	1.22	2.81	1.00	1.12	0.46	0.83	100%
Public Administration	0.05	1.08	0.05	0.22	0.46	2.16	4.52	2.66	0.88	1.58	100%

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